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Cellular localization of infrared sources

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11. SUPPLEMENTARY NOTES

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12a. DISTRIBUTION/AVAILABILITY STATEMENT

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13. ABSTRACT *(Maximum 200 words)*

During the past grant period we developed a special phase-contrast light microscope with an infrared spot illuminator. Using this microscope we were able to show that cultured mammalian tissue cells such as 3T3 cells appeared capable of locating distant, microscopic infrared light sources and aiming for them. The strongest responses were observed if the infrared light sources emitted light of wavelengths in the range of 800-900 nm intermittently at rates of 30-60 pulses per min. In addition, we found that the irradiation of small spots of the cell body induced one or several changes of cell polarity in locomoting 3T3 cells.

This kind of infrared 'vision' of single cells has never been observed before. It may have important conceptual implications for our approach to eukaryotic cells as well as practical implications for the control of wound healing and metastasis.

14. SUBJECT TERMS

Infrared, phototaxis,mammalian cells,tissue culture,motility, centrioles.

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STATEMENT OF THE PROBLEM STUDIED.

Based on our earlier work of more than 15 years it appeared likely that mammalian tissue cells may be able to locate microscopic infrared light sources in their vicinity. It is important to investigate this possibility for the following reasons. The recognition of a cell's immediate and distant environment is likely to play a major role in the control of its motile behavior. Therefore, the investigation of phototaxis and photosensitivity in general of mammalian cells in the infrared may have far reaching consequences for all medical and biological processes that involve cell motility, e.g. the processes of malignant invasion and wound healing. Furthermore, the reactions of tissue to ionizing radiation involves the emission of infrared light to the extent in which the absorbed energy is ultimately turned into heat. Infrared photosensitivity may also have a profound influence on the present concepts of cells: If they are able to respond to infrared radiation which is photochemically inactive, and to determine the location of the source the possibility arises that cells are not merely biochemical automata, but are capable of data-processing in the cytoplasm. In view of the importance of such a cellular ability for wound healing, metastasis and the concept of cells in general we tried to develop the necessary experimental methods. They included the development of tiny infrared light sources with variable wavelengths, new observation chambers, new microscopic condensors suitable for infrared work, special live cell observation chambers and appropriate recording methods. Subsequently, we used the newly developed equipment to study the question whether mammalian tissue cells in culture were able to locate infrared sources at a distance.

SUMMARY OF THE MOST IMPORTANT RESULTS.

We developed successfully a special phase contrast microscope that allowed to irradiate microscopic latex particles (3.22 μm) inside a special live cell observation chamber with a focussed beam of infrared light of variable wavelengths. Using this microscope we found that cells nearby such a infrared light scattering particle were able to locate it at a distance and reach over to it . The most active wavelengths were 800-900 nm. The between particles and the cells' edges had to be less than 60 μm. Furthermore, it was important the the intensity of the light source was not constant. Therefore, we used 30-60 pulses/s to irradiate the latex particles. Additional experiments suggested that the effect was not a simple form of phototaxis, but that the cells were able to distinguish between several individual light sources.

LIST OF ALL PUBLICATIONS DURING THE GRANT PERIOD.

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REPORT OF INVENTIONS
No inventions.